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Rarely have they been the results of work undertaken with the object of attaining the practical. Look at the beginnings of electricity. A piece of amber when rubbed attracts bits of pith. A frog's leg twitches after death when touched in certain ways with metals. That was all. Are such things worth investigating? No doubt the practical man said: 'No; stop trifling: do something worth doing.' And if he had been permitted to have his way, all the wonderful results that depend upon the applications of electricity would have been impossible. In every line, much study, much work, and much investigation are absolutely necessary before enough knowledge can be got together to make profitable, practical applications possible. During this early preparatory stage the work is of no direct interest to the purely practical man; and yet without this work the applications which he values would be impossible. Scientific work in its highest form does not pay directly. Those who devote themselves to the pursuit of pure science do not, as a rule, reap pecuniary reward. They probably enjoy their lives as much as if they did, though it is often difficult to make them believe this. But because it does not yield immediate reward to the worker, should the work stop? Surely not. Our only hope of progress in intellectual as well as practical matters lies in a continuation of this work. And even though not a single tangible, practical result should be reached, the work would be valuable. Why? Because we are all helped by knowledge. The more we know of the universe the better fitted we are to fill our places in the world. All will concede the truth of that proposition. But if this is true we have the strongest argument for scientific work, for it is only through such work that we are enlarging our knowledge. There is no other way of learning. Somebody must be adding to our stock of knowl-

edge, or what we call progress in intellectual and material things would stop. It also seems probable that moral progress is aided by intellectual progress, though it might be difficult to make this perfectly clear. I believe it is so; though of course it does not follow that every individual furnishes evidence of the relation between intellectual and moral progress.

But, my friends, whether we will or not, scientific investigation will go on as it has been going on from the earliest times, and it will go on more and more rapidly with time. The universe is inexhaustible, and its mysteries are inexplicable. We may and must strive to learn all we can, but we can not hope to learn all. We are finite; the mysteries we are dealing with are infinite.

IRA REMSEN.

*HIGHER EDUCATION IN GERMANY AND
THE UNITED STATES.*

AN article on 'Thirty Years' Growth of German Universities,' which recently appeared in one of the educational magazines, suggests an investigation along similar lines with reference to our own country and a comparison of existing conditions. There can be no doubt of the fact that there is manifested in this country an increasing purpose to lead the intellectual or the scientific life, which will inevitably tend to raise the standard of American civilization and culture. The growth of our leading universities within the past decade bears eloquent testimony to this fact, and we have no reason to be dissatisfied with the progress that has been made in the field of higher education. A mere glance at the figures in the above-mentioned article describing the growth of the higher institutions of learning in Germany will convey a good idea of the marvelous intellectual advancement of the nation since the Franco-German war. The author shows that, while there had been an increase of 38.9 per cent.

in the male population of Germany between 1870 and 1900, the number of students in attendance at the universities and schools of technology, mining, forestry, agriculture and veterinary science has grown no less than 163.8 per cent., and allowing graduates of these institutions also to enter into his calculations, he finds that in Germany the number of men of university training has doubled within the last thirty years. The total number of university students for 1900 is given as 46,520 and the number of males in the population of the country as 27,731,000, there being thus 16.78 students for every 10,000 males, as against 8.83 thirty years ago.

In attempting to compare the educational conditions represented by these figures with those of the United States, several obstacles are encountered at the very outset. In the first place, American statistics would not be complete and would not constitute a fair criterion of the educational characteristics of our country, were we to exclude from them all women students, for aside from the large enrollment at colleges for women and the great body of women pursuing graduate or professional courses at the universities, it is not at all unusual to find the women in the collegiate departments of our larger universities, especially the state institutions, far outnumbering the men. It is scarcely necessary to state that in contradistinction to this state of affairs, the policy of permitting women to study at the German universities is just beginning to be looked upon here and there with any degree of favor. It would hardly be appropriate to deny woman a place in the intellectual activities of our nation, and we shall, therefore, arrive at a fairer basis of comparison if we take into consideration not only the number of male inhabitants, but the total population of the country. Adopting this basis, we find that in Ger-

many's population of over 56,000,000 there were in 1900 about eight students for every 10,000 inhabitants.

In the second place, it would be manifestly unjust to Germany were we to draw conclusions in regard to the relative participation of the people in higher education in this country and in Germany without first making deductions for the further dissimilarities of conditions that confront us at every turn. The term higher education, as employed in the United States, is a more comprehensive one than it is in Germany, including as it does with us a large number of college students and students in the academic departments of universities who would not be regarded in Germany as university students. Moreover, in Germany every professional student is in reality a graduate student; no one is permitted to matriculate in the faculty of law, medicine, or theology without possessing the *testimonium maturitatis*, the equivalent—in general terms—of our baccalaureate degree, whereas we can boast of only a few institutions that call for a first degree as a prerequisite for admission to any one of these faculties, notably Harvard University for law, medicine and theology, Columbia University for law, and Johns Hopkins University for medicine. It seems reasonable to suppose that at least the more prominent American universities will adopt the higher admission requirements for the professional faculties within the next decade. At all events, even the most strenuous opponents of the theory must admit that the recent growth of the Harvard law school, which can point with pride to an enrollment of over 700 students, is a splendid justification of the lately adopted ideal condition.

Turning from the American professional schools with their inferior requirements to the so-called graduate or post-graduate faculties, we meet with conditions that are

most encouraging, for the number of graduate students in our universities has more than doubled within the past five years. Columbia University alone has almost 700 resident candidates for the higher degrees registered under its graduate faculties of political science, philosophy and pure science, the majority of whom are preparing themselves for the teaching profession. And here we have another encouraging feature of the educational development of our country, viz., the improved facilities for intellectual growth offered to our teachers by means of summer schools, extension courses, public lectures, and similar enterprises conducted under the auspices of our leading universities. At its summer session of 1903 Harvard enrolled almost 1,400 students, and almost 700 students are at present pursuing resident work at the Teachers College of Columbia University, which this year is also giving extension courses to 1,600 students.

Having called attention to the difficulty of making direct comparisons of the growth of higher education in Germany and the United States, let us at least examine some of the salient features of this growth in both countries. Viewed from the standpoint of increase of proportion of students to the entire population, the comparison slightly favors the United States, although the difference is not great, and the advantage would be lost entirely were we to make due allowance for the differences in conceptions discussed above. The following figures will serve to illustrate this point: In 1870 the United States had a population of 38,000,000, which by 1900 had increased to 76,000,000, *i. e.*, it had virtually doubled. In 1872 there were 8.52 students of both sexes in all branches of higher education to each 10,000 inhabitants, whereas in 1900 there were 19.13, somewhat more than twice as many. In Germany the increase between 1870 and 1900 was a little less than double,

from 8.83 to 16.78 students for every 10,000 males, the total population of the country having increased from 41,000,000 in 1871 to 56,000,000 in 1900. We must also take into consideration the fact that the United States is growing much more rapidly than the German Empire. In the last decade of the nineteenth century the population of Germany increased 14 per cent., while that of the United States increased almost 21 per cent., and this great increase in the population of our own country is comprised largely of immigrants, of whom only a relatively small proportion is interested in higher education. Another interesting fact is brought out by comparing the actual numerical growth of the student body of the two countries, and employing this basis, the comparison would again favor the United States. Between 1889 and 1900 the total number of students in attendance at the German universities increased 36 per cent., whereas in America between 1890 and 1901 the total increase in the number of undergraduate and resident graduate students in universities, colleges and schools of technology amounted to 86 per cent., and there would be little change in the relative growth were the comparison extended to cover the past thirty years.

One of the most interesting points aduced in the article mentioned is the marked change in the distribution of the students among the different classes of institutions, the figures demonstrating that the schools of technology have since 1892 expanded uninterruptedly and much more rapidly than the general universities. The reason for this expansion is to be sought not so much in the existence of lower entrance requirements for the schools of technology, nor in the circumstance that several schools have been permitted to confer an engineering degree, although both of these factors have some bearing on the development in question. We must go

further to find the true cause. During the past decade Germany has made tremendous advances in the field of industries and manufactures, just as has the United States, and the main reason for the increase in the number of students of technology in both countries—the multiplication of this class of students in our own country during the past decade has been quite marked—is found in the endeavor to supply a demand, the prospective student carefully weighing the chances of earning a livelihood in one field or another. Wherever the supply begins to exceed the demand, a tendency toward reduction is immediately felt, as witness the falling off in the number of medical students in this country and elsewhere during the past year, which in spite of increased standards of admission and other minor causes, must be attributed in the main to the existing superabundance of physicians. In other words, at the present day when the professional schools are making such headway at the expense of the old general culture course, university attendance becomes more and more influenced by existing economic and industrial conditions, especially in a country like the United States, in which the practical side of life is emphasized with such vigor, and likewise in a country such as Germany, which during the past few years has adopted so many of our own methods in the conduct of its industrial and commercial affairs. While Germany can not be said to have sacrificed any educational ideals for this new movement, it has at all events allowed the influence of things practical to be strongly felt. In connection with this important question of the widespread increase of applied science students as affecting both Germany and the United States, we might point out that in no instance does a German school of technology form a coherent part of a university proper, as is so frequently the case in this country.

And what is more, it seldom happens that a German technological school is located in a university town, and more than one such school is never, under any circumstance, allowed to exist in the same city, whereas in the United States we revel in the luxury of supporting several technological departments within hailing distance of one another, to mention only Harvard University, the Massachusetts Institute of Technology and Tufts College, for Boston, and Columbia University, the Stevens Institute of Technology and New York University, for New York City, all of which institutions offer courses in applied science.

Nothing furnishes a more vivid illustration of the practical tendencies visible in American education than the existence of departments of commerce and accounts as constituent parts of several of our leading institutions of learning, and the contemplated establishment of a school of journalism in connection with Columbia University is but another phase of this constant and growing endeavor to enlarge the field of legitimate university activity in practical directions.

Summarizing briefly, we have found that both in Germany and in the United States wonderful progress has been made in recent years in the spread of higher education, and this development may be regarded as a specific manifestation of the general material prosperity which has characterized the life of both countries during the past thirty years. The amazing development of the industrial activities of both nations has found a decided reflection in the rapid increase in the enrollments of the schools of technology and the university faculties of applied science, an increase far above the normal and illustrative of the modern striving to bring education into closer and closer accord with the living issues and problems of the day. And no harm will result from this tendency, pro-

vided the proper ideals are never sacrificed to the popular demand, for there seems to be no cogent reason why the intellectual advancement of a nation should not be in perfect harmony with all those things that constitute the sphere of its practical activity. The future of higher education in Germany and in the United States will be proof against all attacks, provided there is no diminution in the proportion of persons animated by a desire to lead the intellectual life, and provided further that we never cease to adhere to those ideals of scholarship and learning which have contributed in such bountiful measure to Germany's commanding position in the educational world.

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SCIENTIFIC BOOKS.

Catalogue of the Ward-Coonley Collection of Meteorites. By HENRY A. WARD, A.M., LL.D. Pp. xii + 113, with 10 plates. Published by the Author. Chicago, May, 1904.

The Ward-Coonley collection of meteorites comprises at the present time representatives of more falls than any other collection in the world. Of about 680 meteorites known, the Ward-Coonley collection contains 603, which is 43 more than the number in the Vienna collection, according to the latest catalogue (1902), and 46 more than the British Museum collection contains, according to its latest catalogue (1904). The attainment of so remarkable a completeness by the Ward-Coonley collection is set forth in the catalogue just published by Professor Ward. The work contains much information of value besides being a catalogue.

In an interesting preface the author describes the manner in which the collection has been built up. Attention is called to the fact that exchange has proved quite as important a means of acquiring meteorites as purchase, and a liberal policy in this regard on the part of museums and collectors who would enlarge their collections is urged. The

Gregory and Siemaschko collections are stated to be largely incorporated in the Ward-Coonley collection, while extensive travel by Professor Ward yielded meteorites obtainable in no other way. The first seventy pages of the catalogue are devoted to a list of the meteorites represented in the collection. These are arranged alphabetically under the groups of siderites, siderolites and aerolites. The list gives the name of the meteorite preferred by the author, its classification according to Brezina's system, the latitude and longitude of the locality and a statement of the locality according to political divisions. Reference to the first description of the meteorite is then given and the weight in grams of the chief piece and total weight in the Ward-Coonley collection. It is evident that great care has been taken to render this part of the catalogue accurate in detail, and the large amount of painstaking labor necessary to achieve this result can be appreciated only by those who have essayed similar tasks. So thoroughly has the work been done, however, that this catalogue may be considered the most authoritative work now extant in regard to the names and localities of the meteorites which it lists. American locality names of meteorites in particular have suffered so woefully from the mistakes of foreign authorities hitherto that it is cause for congratulation that the matter has been taken in hand by one so familiar with the subject as Professor Ward.

Following the list of specimens in the Ward-Coonley collection, an alphabetical list of all known meteorites is given with such synonyms as have importance. Here again the wide experience and knowledge of the author give the list a peculiar value. It has not been burdened with synonyms resulting from imperfect or careless spelling, but genuine synonyms have been retained.

The next division of the catalogue shows the geographical distribution of all known meteorites according to countries. The meteorites of each country are arranged alphabetically under that division and their date of fall or find, and classification as iron or stone shown. Division VI. of the catalogue has been contributed by Dr. Brezina, of Vienna.